Agriculture/Forestry

Submitted by Dr. Anthony Turhollow (Oak Ridge National Laboratory and Utah State University) and Dr. Helga Van Miegroet (Utah State University) on June 2, 2007:

General Comments

- Overall, the recommendation should link better to past research and assessments conducted elsewhere in the US. Many of the statements and recommendations appear in a relative vacuum relative to current state of the science.
- There is a lot of focus, especially in forest-related activities on the C sequestration in biomass with relative little attention to effects on soil C. But, it should be noted that in terrestrial (wildland) ecosystems 2-3 times as much C is stored in the soil than in the aboveground biomass; therefore what happens to that C can have an important impact on the overall outcome of any of the proposed scenarios
- General caution -- Water is an issue not to be ignored.

i.e. is there enough to actually grow biomass fuels?

1.c.ii. Converting lands to grasslands or forests – water issue, how it is done is important!

- In several cases there is a contradiction between recommendations under different headings i.e. as a whole, the bundle of recommendations should be screened for inconsistencies and be made more consistent across the board.

AF-1 – promote production of biomass fuels

Does not make sense to import biomass, but import finished product.
See work at USU by Sims et al on scum (pond, sewage?)
Biodiesel – use waste oils from restaurants, other food processing
Footnote 2 – what replaces Pinyon-Juniper important for C impact ; issue is also what effect PJ encroachment has on soil C stocks – does it decline – there is some evidence in literature that "lignification" i.e. encroachment by woody species may reduce soil C stocks

AF-2 - Improved nutrient management

Do not understand paragraph after benefit/cost numbers
Reduce N emissions and get CO_2 reduction (maybe but I do not follow logic)
What is the true extent of the nutrient management problems with home/hobby gardening? –is there data to back op statement?
Anaerobic digestors:
See **2002 Final Report: Haubenschild Farms Anaerobic Digester Updated**! Attached pdf file "*HaubenschildAnaerobicDigestors.pdf*"
AgSTAR program of EPA/DOE/USDA on anaerobic digestors
See also: Krich, Ken, Don Augenstein, JP Batmale, John Benemann, Brad Rutledge, and Dara Salour. 2005. Biomethane from dairy waste: a sourcebook for the production and use of renewable natural gas in California. Prepared for Western United Dairyman. Accessed at: http://www.westernuniteddairymen.com/USDA%20Grant/USDAgrantfinalreport.htm.

If designed properly anaerobic digestors can work

Look at: http://bioweb.sungrant.org/ for information on many things biomass.

AF-3 Change Livestock feed

line above **Assessment** 1,271,105 tons emitted of what, CH_4?

AF-4 Innovative Soil Management

Till/no till : not clear whether this approach to planting crops reduces CO_2? – not sure where this statement was derived.

There is quite a significant literature on the importance of conservation tillage and residue management to carbon storage – The focus on C stabilization is through protection of C within soil aggregates and micro-aggregates (C attaches itself to mineral particles in strong bonds). Anything that breaks up aggregates and causes greater physical mixing of soil particles, increases microbial contact and possible decomposition = gaseous loss of stored soil C; in higher rainfall areas C loss can also occur through leaching.

Reference examples are

- Lal, Kimble & Follett 1997 Chapter 1 "Land use and soil C pool in terrestrial ecosystems" and Chapter 31 "Need for research and need for action" IN: Lal, Kimble, Ffollett & Stewart (eds) Management of Carbon sequestration in soil CRC Press –> general recommendations on soil management practices
- Burke et al. 1995. Soil organic matter recovery in semi-arid grasslands: implications for the conservation reserve program. *Ecol Applications* 5: 793-801 -> NE Colorado
- Gebhart et al. 1994. The CRP increases soil organic carbon. Soil and Water Cons. 49:488-492 –> average storage of 1.1 T C per ha per yr (Kansas, Texas, Nebraska)
- Six et al. 2000. Soil macroaggregate turnover and microaggregate formation: a mechanisms for C sequestration under no-tillage agriculture. Soil Biology and Biochemistry 32: 2099-2103
- Denef et al. Carbon sequestration in microaggregates of no-tillage soils with different clay mineralogy *Soil Sci Soc America Journal* 68:1935-1944

Furthermore, alternatives to conventional tillage are already incorporated under the C offset program within the Chicago Climate exchange, so there ism a system being developed to give farmers credit for sequestering C, see:
http://www.chicagoclimatex.com/environment/offsets/index.html

Organic farming increases soil C because manure used instead of commercial fertilizers? Is there any data on how effective this really is. Also, this management practice then overlaps with manure management (nutrient additions) issue under AF-2 and needs to be made consistent with the recommendations made there.

AF-5 Convert Land to Grassland or Forests

It is not clear to what extent this recommendation refers to aboveground biomass C sequestration or to soil C sequestration, if looking at soil C sequestration, a good reference on effect of landuse on soil C is

Guo & Gifford. 2002. Soil carbon stocks and land use change: a meta analysis *Global Change Biology* 8: 345-360.

This reference also indicates that there soil C gain of converted croplands depends on forest vs. plantation, species composition , and rainfall (production potential!) When growing trees for energy (energy plantation), one also has to consider need for fertilization and the greenhouse costs associated with their production.

2nd to last paragraph Utah pays farmers to set aside buffer strips. But farmers do not own all lands. Need to protect riparian areas regardless of ownership.

AF-6 Preserve Open Space

carbon sequestration only secondary benefit of open land preservation – perhaps this should not be the focus, as the argument is not particularly strong or well-documented

2nd paragraph " Sequestration and uptake is greater in agriculture than other landuses" – what is this statement based on? Runs directly counter to AF-5! Perhaps need to specify what "other land uses" are. Compared to forests, plantations, and pastures, croplands results to a reduction in soil C pool (see Meta-analysis in Guo and Gifford 2002). Also, when soils are entirely isolated from the air (i.e. structures, parking lots, roads etc – the C that is residing in soil is ultimately stable as it has not way of decomposing and emitting CO_2

Footnote 15 exactly what does this mean "higher carbon retention and decreased transportation activity" ?

AF-7 Protect Forest Land

What does "rural lands" stand for?
It has indeed been documented that conversion of forests, plantation (and grasslands) to crop lands does indeed reduce the soil carbon stock -- is that the meaning of this statement?

"Healthy forests promote carbon sequestration and reduce carbon release" – What exactly is meant by this? This stop-gap statement shows up under various headings and is not very well documented (AF-7, AF-8, AF-12)
Important to be specific as to what is meant by C sequestration. If one looks at total storage (C pools in biomass and soil) there is indeed a lot stored there; However, many healthy, fully functioning forest ecosystems do not reduce carbon release and are C neutral at best – i.e. the amount of CO_2 that is sequestered annually by the trees is the equal to the amount of C released from the decomposition of debris that sits on top of the soil. Fires are essentially the same C release process, the only thing that differs is the time frame within which this residue-derive C is released. However, taken over decades or centuries the average amount of C release from fire and natural decomposition may actually be the same (related to how much C was contained in the residue)

Why did state lose over $1 million?

AF-8 Encourage afforestation and restoration non-forest land

This is really supplemental to AF-7 (reduce loss of forest)
"Productive trees can reduce carbon" – see earlier comment – depends largely on where you are in developmental phase of forest, net C accumulation tends to only occur in aggrading phase (rapid growth); older and mature forests have more limited growth (= lower C capturing potential) while more C can be released through decay of accumulated dead woody material laying on ground. The net benefit on C of growing trees depends largely on what is being done with that wood: stored in durable goods vs. combusted for energy? In the latter case, the fossil fuel displacement efficiency needs to be considered. For an interesting conceptual analysis, see for example

Marland, G. and B. Schlamadinger. 1997. Forests for carbon sequestration or fossil fuel substitution? A sensitivity analysis. *Biomass and Bioenergy* 13(6):389-397.

When growing trees for energy (energy plantation), one also has to consider need for fertilization and the greenhouse costs associated with their production.

AF-9 Promote Urban and Community Trees

Statements under Benefit/Cost of reducing CO_2e is nill or not cost effective, yet 1st para states tremendous opportunities. Would say some opportunity, but perhaps the greatest benefit of urban trees is NOT the biological C sequestration by the trees, but the reduction of the heat island effect

Talk with Mike Kuhns, Extension Forester at USU

AF-10 Promote Reforestation and Proper Management of stands

Not exactly clear what the exact recommendations are under this rubric

Compare "Age extension of forest stands…" paragraph versus AF-14 statements on "larger trees that sequester more carbon" -- these statements run a bit counter to what we know about forest and tree ecology i.e. that maximum C capturing capacity occurs at the early stages of forest development (i.e. plantation, secondary forest following disturbance) when overall biomass is increasing. When forest matures, trees are getting bigger, overall wood increment tapers off as the canopy (photo-synthesizing i.e. C capturing apparatus) reaches a plateau value (Leaf area index function of moisture availability), and the tree starts accumulating more and more respiring (i.e. C releasing) structures (such as branches and wood) . Every forester knows this as it is indicated by growth and yield curves. That is how rotation lengths for specific forests are determined. People who have calculated net C balance for forest, also indicate that systems tend towards becoming C neutral (or even sources of C) (see earlier comment).

AF-11 Develop and Implement Best Management Practices fore Biomass Removal

Improved logging residue removal, develop feedstocks for energy production

We have been here before, as a matter of fact, in the 1970 and 1980, the US Dept. of Energy sponsored a series of nation-wide field trials and assessments on this track of thinking and there is an extensive literature to be found on the this topic from the late 1980s to early 1990s. The thinking was the same at that time, and the thought was abandoned because other considerations (besides using wood and residue carbon as an energy source) prevailed such as increased erosion loss, excessive nutrient removal , soil degradation and loss of soil productive capacity (not even including loss of habitat and species diversity issues). As a result of those earlier experiments, there has been a lot more focus on the impact of intensive management practices on productive capacity of forest soils that are contained in the Montreal Protocol (which the US co-signed)

•**Santiago Declaration (1992)** "Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests" **("Montreal Process"1995)**

Criterion 4. Conservation and maintenance of soil and water: Area or % of land with significantly diminished **soil organic matter** and/or changes in other soil chemical properties.

If fertilization has to be implemented to compensate for the extra nutrient removal associated with intensive harvesting and residue removal, one has to also take into account the CO_2 emission coasts associated with their production and delivery to the site (i.e. C life cycle analysis).

Bottomline – this recommendation is ill-advised based on prior experiences nationwide from DOE-sponsored research

"Options for reducing biomass include burning it, bringing in goats…other mechanical means" Why the focus on removing biomass using fire or animals ? – Anytime you burn (=accelerated natural decay process) or digest C you release CO2, so this recommendation is counter to reducing CO_2 emissions

Woody biomass is carbon neutral – depends on what you do with it and the fossil fuel displacement efficiency (see Marland and Schlamadinger article for discussion)

AF-12 Increase Fire Management

Some of statements are counter to recommendations under AF-11 where you want to remove forest floor residue

"Healthy forests take up carbon" – see earlier comment. Not necessarily so, many mature and old growth forests (with a lot of C stock accumulated) are actually C neutral

"Healthy forests are less likely to burn" – consider that fire is part of normal fire cycle of some forests and that fire is actually needed for regeneration.

Perhaps focus should be on restoring natural fire regimes and avoid catastrophic fires from an ecological NOT carbon standpoint. What happens to dead residue on the forest floor is the same whether it decays, is consumed in prescribed burn, or by catastrophic wildfire: the organic C is converted into CO_2 and released to the atmosphere (only the time frame it which this happens differs)
However other considerations may be more important, such as:
- controlled burn gives off less CO, CH_4 in addition to particulates
- In catastrophic wildfires, standing biomass is also consumed (rather than having the ability to route to C towards fossil fuel displacing energy source, or long-term C storage)
- Increased erosion risk associated with total loss of cover and forest floor
- Loss of soil organic matter, nutrients and reduction in productive capacity see for example Johnson and Curtis. 2001 Effects of forest management on soil C and N storage: a meta analysis. *Forest Ecol. & Manage* 140: 227-238.

Last para – use thinnings for energy purposes: is this really feasible economically?

AF-13 Increase Forest Health

"Healthy forests are of critical importance for carbon and other issues" – recurring stop-gap statement that needs more elaboration to be convincing
"Healthy forests take up carbon and sequester it " – debatable in some cases, see earlier comments " … and are less likely to lose it catastrophically" – is that backed up by real data?

"Healthy grasslands and aspen may sequester more C than other mixes of trees and plants" -- suppose it is possible, but is it generally true? Is there data to support this statement?
If focus is on biomass C, then C sequestration potential depends on net primary productivity which is largely under climatic control, not clear that production of grassland is indeed greater than that of forests
If focus is on soil C, then this statement is currently not always supported by existing data, and findings can be contradictory
There are several statements in the literature that indicate that grasslands have higher soil organic matter stocks than forests and that the soil C is more stable.

- Knoepp et al 1997 Forest Management effect on soils C and N. Soil Sci. Soc. Am.J. 61:928-935. → conversion of mixed hardwoods to white pine increased soil C
- Guo & Gifford. 2002. Soil carbon stocks and land use change: a meta analysis *Global Change Biology* 8: 345-360.→ difference between grasslands and forest plantation function of forest type, species, and regional precipitation ; conversion of pasture to forest plantation is sometimes soil C neutral (hardwood), sometimes associated with C loss (conifers)

Bringing in aspen in this discussion becomes a bit of a diversion point (red hering) as there is no published evidence that transition of aspen to conifer forests is associated with a measurable loss in C in the soil. Current research underway by USU faculty at the Deseret Land and Livestock and the Wasatch – Cache National Forest to specifically investigate this issue, as conifer encroachment is an issue of public interest.

AF-14 Expand Use of Wood products

"larger trees sequester more carbon"
if one consider total (static) pool in each tree : yes
if one actually looks at net annual C sequestration rate (dynamic) – less straight forward (more respiration costs because more non-photosynthesically active tissues)

AF-15 Expand Use of Forest Biomass Feedstocks

What is "CO_2 intense electricity"?

Credentials Dr. Anthony Turhollow

Ph.D. Agricultural Economics, Iowa State University 1982
MS Environmental Engineering, Utah State University, 1998

Staff economist - Oak Ridge National Laboratory, 1982-1993, 1998-present

Specialty: biomass energy, working in field since 1980

Estimate costs of: 1) collecting corn residues and energy crops for use as energy (also investigate logistics and handling), 2) evaluate cost estimates for new pesticide products, 3) establishing riparian buffer strips and producing biomass on riparian buffer strips, and 4) opportunities to reduce costs, pollutants, and energy use in forest products industries. U.S. Department of Energy's Biofuels Feedstock Development Program as program manager and economic and research analyst. Task manager for oilseed crops development, 1984-1990. Other activities included: CO_2, agriculture, Energy Information Administration biomass research.

Biomass Consultant, October 1993 to present. Estimate cost of harvesting sugar cane residues, cost of herbaceous energy crop harvest, cost of wood transport, CO_2 and other greenhouse gases from energy crops, costs and quantities crop residues for energy, and impacts of increased oilseed production in the Southeast.

Detailee, May 1992 to September 1992, Office of Technology Assessment (OTA), Congress of the United States. Research on chapter on biomass for OTA report on renewable energy.

17 refereed journal articles on biomass and energy use in agriculture.

Published one of first papers on corn ethanol energy balance: Marland, G. and A. F. Turhollow, "CO_2 Emissions from the Production and Combustion of Fuel Ethanol from Corn," *Energy*, 16(11/12):1307-1316, 1991.

Credentials Dr. Helga Van Miegroet

Ph.D. Forest Soils and Mineral Cycling, University of Washington 1986

Research Staff - Oak Ridge National Laboratory, 1987-1993
Faculty – Utah State University, College of Natural Resources, 1993-present

Specialty: Soil processes, mineral cycling, and nutrient transport mechanisms in; Effect of disturbance, management, vegetation change and environmental stressors on carbon and nutrient dynamics in wildland ecosystems.

Consultant: to EPA, Nat. Park Service, U.S. Forest Service and other land stewardship Agencies on effects of pollution on soil processes and nutrient transport mechanisms

70+ Publications focusing on effects of management, anthropogenic and climatic stressors on forest and rangeland systems in various ecoregions of the US, including:

- environmental effects of harvesting and fertilizer applications
- site productivity and soil quality in managed forests
- effects of air pollution on nutrient transport from terrestrial to aquatic systems
- carbon quality/stability and sequestration in forest and rangeland systems

Several Journal articles on C cycling and C sequestration in wildland ecosystems:

Moore, P.T., H. Van Miegroet, and N.S. Nicholas. 2007. Relative role of understory and overstory in carbon and nitrogen cycling in a southern Appalachian spruce-fir forest. *Can. J. Forest Res.* (Accepted).

Tewksbury, C.E. & H. Van Miegroet. 2007. Soil organic carbon dynamics along a climatic gradient in a southern Appalachian spruce-fir forest. *Can. J. Forest Res. (In Press)*

Van Miegroet H. & R. Jandl. 2007. Are nitrogen-fertilized forest soils sinks or sources of carbon? *Environmental Monitoring and Assessment* 128: 121-131.

Van Miegroet, H., P. Moore, C. Tewksbury & N.S. Nicholas. 2007. Carbon sources and sinks in high-elevation spruce-fir forests in the Southeastern US. *Forest Ecol. & Manage.* 238:249-260.

Van Miegroet, H., J.L. Boettinger, M.A. Baker, J. Nielsen, D. Evans, & A. Stum. 2005. Soil carbon distribution and quality in a montane rangeland-forest mosaic in northern Utah. *Forest Ecol. & Manage.* 220: 284-299.

Schoenholtz, S.H., H. Van Miegroet, & J.A. Burger. 2000. Physical and chemical properties as indicators of forest soil quality: Challenges and opportunities. *Forest Ecol. & Manage.* 138: 335-356.

Van Miegroet, H., M.T. Hysell, & A. Denton Johnson 2000. Soil microclimate and chemistry of spruce-fir tree islands in Northern Utah. *Soil Sci. Soc. Am. J.* 64:1515-1525.

Herrmann, R., R. Stottlemyer, J.C. Zak, R.L. Edmonds, & H. Van Miegroet. 2000. Biogeochemical effects of global change on U.S. National Parks. *J. Am. Water Resources Assoc.* 36(2): 337-346.

Agriculture/Forestry

Submitted by Andre Shoumatoff, Utah Biodiesel, June 19, 2007:

Utah Biodiesel Cooperative (UBC), Utah's biodiesel education, advocacy, and research organization, wishing to make the following comments in regards to **AF-1 and biodiesel fuel in Utah in general:**

Biodiesel, unlike other AG fuels, is efficient to produce and is by far, the easiest alternative fuel to implement because you simply put it into any diesel vehicle. Diesel vehicles do not require modification to run it unlike all other alternative fuels. According to data from the National Biodiesel Board (NBB), it is a 78% reduction of greenhouse gas per unit. It also offers drastic, sweeping emissions reductions in all categories, including complete elimination of sulfur, with exception of possibilities of slight increases of NOx . 36 states are currently producing biodiesel including states with similar climates as Utah (Idaho, for example, is a national leader). Utah currently has basically little or no biodiesel production, largely related to the business and political climate, not water issues. Utah, however, developed a fairly advanced biodiesel distribution system. It is possible that Utah may see as high as 15 million gallons of biodiesel produced per year by the end of 2008 based on announcements from several other corporations saying that they plan to produce biodiesel here, including Flying J oil refineries. The big future of biodiesel in Utah lies in its production of feedstocks specifically from algae-for-biodiesel, which is why we requested that AF-1 be place in a high priority category. This is most closely related to Utah's unique geographic location: one day away by transport to every major city in the west, and followed by inexpensive land, high labor quality at low costs, and plentiful sunlight and low required water usage for an enclosed algae production facility, which is the big future of biodiesel feedstock production in general. Recently, USU Logan was awarded a $6.5 million grant to develop biodiesel-from-algae technologies. A $100 million algae-from-biodiesel plant in Utah could produce in excess of 1 billion gallons of low-cost biodiesel feedstock, which currently more than the entire biodiesel industry. NBB estimates that the biodiesel industry will exceed $30 billion by 2020. Related to future impacts of global warming, currently a whopping 30% of all investments are being put into future renewable technologies, including production of biodiesel.

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Cross-Cutting

Submitted by Mike Peterson, Rural Electric Association on June 19, 2007:

I know I am not part of the Stakeholder Working Group on Climate Change, but I wanted to submit several comments as an observer at the June 12, 2007 meeting.

- It would beneficial for someone seeing the sector group reports for the first time to have an explanation/justification as to why an item was given a high priority or assigned a certain Bin ranking by the sector group.

- I appreciate what appears to be an attempt to assign costs to the various measures by CO2/ton by referencing numbers from other states. However, the group should evaluate what those costs would be to Utah residents.

Utah's carbon foot print is significant compared to some of the other states which signed the Governor's Climate change compact. Thus, the impact to electric ratepayers could be much larger for Utah than for residents of California, Washington and Oregon. We need to have a clear understanding of what that impact would be.

For example, the draft from the CC sector group pointed to one study with a suggested carbon tax of $100/ton of carbon and then showed a resultant price increase for electricity from coal to be 2.2 cents/kWh. Because the number of customers served by Utah's rural electric co-ops is small, and their dependence on coal-fired power higher, this type of tax would be devastating. Rural electric cooperative customers would see triple digit percentage increases in their rates. Our rural members and economies would not have the capacity to absorb this type of increase.

In a similar fashion we need to recognize renewable portfolio standards will also impact regions, states, and communities differently. Utah's rural electric cooperatives formed Deseret Power and built the Bonanza Power Plant nearly 22 years ago. The plant was built to serve potential oil shale development and the MX missile system, both of which did not materialize. As a result these electric cooperatives still have surplus electricity. Thus, any mandate to purchase renewable power could potentially cause those electric cooperatives to displace a lower cost resource into the market to be used by others and replace it with a higher cost alternative for their ratepayers.

We need to be very cautious about making quick, reflexive decisions to recommend policies and/or mandates before technologies are available to meet them and potentially raise electricity rates to incentivize alternative generation that doesn't meet consumer needs. We could cause electricity prices to rise sharply while doing little to change climate.

As a general observation there seems to be, at least from the federal level, an unstated belief that our national energy policy should include policies that will harm consumers. Among our concerns is the idea of raising electric rates very high to promote energy conservation among consumers by changing their consumption habits and turning devices off or buying high efficiency appliances. This strategy could be the same as a regressive tax on less affluent households with a disproportionate impact on those households if this strategy is not managed well because it does not recognize the regional differences in electricity generation, usage and needs. We need to make sure we understand how Utah citizens and businesses fit into these types of policy initiatives.

I highly recommend the group include estimates of potential cost and overall economic impacts to Utah residents and businesses and not rely on broad regional or national perspectives.

- During the transportation sector report there was mention of the Governor converting his SUV to compressed natural gas. We need to make sure that in our quest for energy independence we do not do things that could switch our dependence on foreign sources from one fuel to another. With natural gas now being used to power most all new electric generation, our nation could soon be dependant on imports of liquified natural gas as much as we are dependant on oil to keep our economy going.

Finally, we need to be careful that our attempts in Utah and the United States to lower levels of CO_2 unilaterally don't result in higher energy prices here that could force industry to locate abroad in countries with little or no emphasis on controlling CO_2 emissions, thereby actually increasing global levels of CO_2.

Thank you,

Mike Peterson
Utah Rural Electric Association

Energy Supply

Submitted by Kyle L. Davis, PacifiCorp, June 4, 2007:

(Scroll to next page)

Utah Blue Ribbon Advisory Council on Climate Change - Energy Supply Catalog of State Actions

Proposed IGCC/CCS Incentives in Utah (ES Cat B and Cat C)

A. The Need for Clean Coal Technologies to Meet Emissions Reduction Targets.

On May 21, 2007, Governor Huntsman signed on to the Western Regional Climate Action Initiative.[1] The Initaitive directs the states of Arizona, California, New Mexico, Oregon, Washington, and now Utah to develop a regional target for reducing greenhouse gases (GHG) by August 2007. By August 2008, they are expected to devise a market-based program, such as a load-based cap-and-trade program to reach the GHG target. The five states also have agreed to participate in a multi-state registry to track and manage greenhouse gas emissions in their region.

In addition to increased efficiency and renewable energy investment, the development and commercialization of advanced clean coal technology is a critical third component in the portfolio of GHG mitigation actions. The most viable of these technologies today appears to be Integrated Gasification Combined Cycle (IGCC) combined with carbon capture and storage (CCS) technology. There are also emerging CCS technologies that show promise for capturing carbon emissions from traditional pulverized coal fired boilers. These emerging technologies include chilled ammonia scrubbing and oxy-fuel combustion. Carbon capture technologies have the potential to remove approximately 90 percent of a coal plant's CO2 emissions.[2]

IGCC plants generate electricity by gasifying coal and using clean "syn-gas" to fuel a combustion turbine in a combined cycle configuration. IGCC technologies have improved efficiencies compared to traditional pulverized coal plants. The overall efficiency of an IGCC plant depends on gasifier technology and coal type. Improvements in overall efficiency translate into reductions in CO2 emissions; for every one percent of efficiency gain, a plant produces about 2 percent less CO2 per kWh.[3] A generic IGCC plant has a CO2 emissions rate of 1600-1760 lb/MWh as compared to a rate of 2000 lb/MWh for a traditional coal plant.[4] IGCC plants also have reduced air pollutant emissions, such as sulfur dioxide (SO2), nitrogen oxide (NOX) and mercury,[5] compared to pulverized coal-fired plants. Additionally, using currently available

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[1] See, http://gov.ca.gov/mp3/press/022607_WesternClimateAgreementFinal.pdf

[2] PacifiCorp's 2004 IRP at 23, located at http://www.pacificorp.com/File/File47422.

[3] U.S. Department of Energy Fact Sheet: Clean Coal Technology Ushers in New Era in Energy, located at http://www.state.gov/g/oes/rls/or/2006/77196.

[4] "Exhibit 3-18, Emission Data from the Literature" page 3-29, from the Final Report, "Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies", EPA-430/R-06-006, United States Environmental Protection Agency, July 2006, located at http://www.epa.gov/airmarkets/articles/IGCCreport.pdf.

[5] PacifiCorp's 2004 Integrated Resource Plan (IRP) Update estimated IGCC reductions of 73% for SO2, 85% for NOX and 22% for mercury over a supercritical pulverized coal plant. PacifiCorp's 2004 IRP Update at 24, located at http://pacificorp.com/File/File57884.

commercial separation technologies, the cost of carbon capture from an IGCC plant is expected to be lower than the cost to capture carbon emissions from a traditional pulverized coal plant.

Both environmental and national security concerns support the accelerated development of advanced clean coal technologies. The North American Electricity Reliability Council recently reported that demand for electricity is increasing three times faster than new generating resources can be added.[6] Coal is the nation's most abundant fuel source.[7] Coal now accounts for 50 percent of the electricity generated in the U.S. and, as the lowest cost source of electricity generation, this percentage is expected to increase.[8]

The important role of advanced clean coal technology is recognized in the Western Public Utility Commissions' Joint Action Framework on Climate Change, signed on December 1, 2006 by the Washington, Oregon, California and New Mexico public utility commissions.[9] The Framework's Statement of Shared Principles includes five principles, the second of which is "Development and use of low carbon technologies in the energy sector." The third of six Action Items is: "Explore ways to remove barriers to development of advanced, low-carbon technologies for fossil fuel-powered generation capable of capturing and sequestering carbon dioxide emissions."

B. Removing Barriers and Providing Incentives to IGCC and CCS Technology Commercialization.

There are a number of barriers that stand in the way of large scale commercial development of IGCC and CCS technologies, particularly for investor-owned utilities (IOUs). Over the last several years, many states and the federal government have passed laws to address the most problematic of these. To promote Utah policies on climate change and sustainability, Utah should join these lawmakers in enacting clean coal legislation.

a. The Need for a Comprehensive Legal and Regulatory Framework for CCS.

CCS raises new legal and regulatory risks associated with siting and permitting projects, CO2 transportation, injection and storage.[10] These risks are not yet fully understood, nor are uniform standards or government regimes in place to address and mitigate them.

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[6] *Mixed Signals Leave Developers Wary of Building New Infrastructure*, 144 Pub Util Fort 4 (Nov 2006).

[7] *Financing Clean Coal*, 143 Pub Util Fort 73 (June 2005).

[8] U.S. Department of Energy Fact Sheet, supra note 3.

[9] Western Public Utility Commissions' Joint Action Framework on Climate Change (December 1, 2006), located at http://www.puc.state.or.us/puc/news/2006/2006026jointaction.

[10] Robertson, K., Findsen, J., Messner, S., Science Applications International Corporation. June 23, 2006. "International Carbon Capture and Storage Projects Overcoming Legal Barriers", prepared for the National Energy Technology Laboratory (see http://www.netl.doe.gov/energy-analyses/pubs/CCSregulatorypaperFinalReport.pdf)

Among the key questions to be addressed in the development of a consistent regulatory framework for CCS are: immunity from potentially applicable criminal and civil environmental penalties; property rights, including the passage of title to CO2 (including to the government) during transportation, injection and storage; government-mandated caps on long-term CO2 liability, insurance coverage for short-term CO2 liability; the licensing of CO2 transportation and storage operators, intellectual property rights related to CCS, and monitoring of CO2 storage facilities.

California recently adopted AB 1925, directing the California Energy Commission to recommend standards to accelerate the adoption of long-term management of industrial CO2.[11] Utah should similarly develop guidelines for addressing the emerging legal and regulatory issues associated with CCS. Among the options it should explore is that adopted by Texas, which transfers the title (and any liability post-capture) to CO2 captured by CCS to the Railroads Commission of Texas.[12]

b. The Traditional Least-Cost/Least Risk Regulatory Standard Should Be Modified to Allow Development of CCS-Equipped IGCC and Pulverized Coal Resources.

IGCC plants have higher capital and operating costs than traditional coal plants. PacifiCorp's 2004 Integrated Resource Plan Update analyzed the costs of an IGCC plant equipped with CCS technology. This analysis demonstrated that a CCS-ready, IGCC plant costs at least 16.9% more than a supercritical pulverized coal plant.[13] Additionally, while reliable estimates for carbon geologic sequestration costs do not yet exist, the Department of Energy's research program goal is $10 per MWh.[14]

IOUs in Utah are subject to a least cost, least risk standard for new resources.[15] Additionally, Utah IOUs are required to implement their integrated resource plans through competitive bidding to ensure implementation of this least cost policy.[16] Because the costs of IGCC and CCS technologies are higher than uncontrolled traditional pulverized coal, an IGCC or a CCS investment is difficult to justify under a least cost/least risk standard. For example, in 2003, the Wisconsin Public Service Commission rejected Wisconsin Electric's request for a certificate of need for an IGCC plant on the basis that the plant was not cost-effective.[17]

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[11] California AB 1925 (2006), located at http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_1901-1950/ab_1925_bill_20060926_chaptered.

[12] Texas H.B. 149 (2006).

[13] PacifiCorp 2004 IRP Update at 24, supra note 5.

[14] *Id*.

[15] *See Energy Resource Procurement Act, Utah Code Ann. § 54-17-302(3)*

[16] *See Energy Resource Procurement Act, Utah Code Ann. § 54-17-101 et. seq. (for resources greater than 100 MW with a life or term of ten years or more.)*

[17] *In re: Wisconsin Electric Power Company*, 05-CE-130 (Nov 10, 2003).

Utah should eliminate this barrier to IGCC and CCS technologies for IOUs by adopting a "reasonable and necessary" standard for IGCC and CCS technologies used to serve Utah customers, in place of a least cost/least risk standard. Indiana adopted a similar approach, requiring the Indiana Utility Regulatory Commission to encourage the development of IGCC and CCS as long as it concludes that the projects are reasonable and necessary.[18]

c. Utah Should Enact Tax Incentives to Help Bridge the Cost Gap Between IGCC and CCS Technologies and Traditional Uncontrolled Coal.

To bridge the cost gap between IGCC and CCS technologies and traditional coal, EPACT 2005 contained new investment tax credits for advanced coal technologies, including IGCC.[19] EPACT 2005's IGCC tax credits were heavily over-subscribed, however, with applications totaling $5 billion for only $1.6 billion in credits.[20]

Utah should enact tax incentives to encourage new IGCC and CCS development to serve Utah customers, adding to those already exhausted under EPACT 2005. The most effective combination of tax incentives for IOU development of IGCC and CCS technologies is a tax credit plus accelerated depreciation.

d. The Added Risks and Financing Challenges of IGCC and CCS Should Be Mitigated With Assured, Timely Cost-Recovery.

The developmental nature of IGCC and CCS technologies creates added risk and cost during the pre-construction phase, in construction of the plant and in the plant's performance. While engineering and construction designs for a traditional coal plant cost less than $1 million, an IGCC plant cannot be built without a Front End Engineering Design (FEED) study. Such a study costs $10-$20 million and requires 10-14 months for completion.[21] Because commercial-scale IGCC and CCS technologies are new, the risk of cost-overruns, construction delays and delays in achieving anticipated reliability levels are all higher than for a traditional coal plant.

This added risk and cost create financing challenges for an IGCC or CCS investment. Assured, timely cost recovery, typically achieved by "pay as you go" proposals, is necessary for large IGCC or CCS projects to obtain financing and move forward. For example, the Ohio Public Utilities Commission recently allowed American Electric Power (AEP) to recover an estimated $23.7 million in first-phase IGCC pre-construction costs through a 12-month

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[18] IC 8-1-8.8-11(a), provides that "The Commission shall encourage clean coal and energy projects by creating the following financial incentives for clean coal and energy projects, if the projects are found to be reasonable and necessary."

[19] EPACT 2005, Title XIII, Subtitle A, Section 1307

[20] U.S. Department of Energy Fact Sheet, supra note 3.

[21] PacifiCorp 2004 IRP Update at 26, supra note 5.

generation surcharge.[22] AEP proposed a second-phase of recovery during construction to cover financing costs, and a third-phase to recovery the costs of the plant after it becomes operational. Similarly, the Indiana Utility Regulatory Commission approved the requests of two utilities for deferral and recovery of IGCC pre-construction costs.[23]

Utah should adopt a full and timely cost-recovery standard for IOU investment in IGCC or CCS technologies used to serve Utah customers. Utah Code Ann. § 54-4-4(3) currently allows, but does not require, the Commission to use a future test period in setting retail rates.[24] To mandate "pay as you go" cost recovery for IGCC or CCS investments, Utah's clean coal legislation would need to create a limited exception to this statute for IGCC and CCS investments. Colorado, Indiana and Pennsylvania all provide full cost-recovery assurances for IGCC and CCS by statute; Colorado additionally includes recovery for replacement power costs associated with unplanned IGCC plant outages.[25]

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[22] *In re Columbus Southern Power Co. and Ohio Power Co.*, Case No. 05-376-EL-UNC (Ohio PUC April 10, 2006).

[23] *In re PSI Energy*, Cause 42894 (Indiana URC July 26, 2006).

[24] Utah Code Ann. § 54-4-4((3) (a) If in the commission's determination of just and reasonable rates the commission uses a test period, the commission shall select a test period that, on the basis of evidence, the commission finds best reflects the conditions that a public utility will encounter during the period when the rates determined by the commission will be in effect.
(b) In establishing the test period determined in Subsection (3)(a), the commission may use:
  (i) a future test period that is determined on the basis of projected data not exceeding 20 months from the date a proposed rate increase or decrease is filed with the commission under Section 54 7 12;
  (ii) a test period that is:
    (A) determined on the basis of historic data; and
    (B) adjusted for known and measurable changes; or
  (iii) a test period that is determined on the basis of a combination of:
    (A) future projections; and
    (B) historic data..

[25] Colorado House Bill 06-1281; Indiana IC 8-1-8.8; Pennsylvania SB 1030.

Energy Supply

Submitted by Hans Ehrbar, Utah Jobs with Justice, June 20, 2007:

Utah has exceptional potential for solar and geothermal renewable energy. Since these technologies are in their infancy, they may still be less cost effective than other renewable sources. This note here discusses policies that would push them forward along their technological development path. Such policies not only have the advantage of providing Utahns with locally produced clean energy, but they also have the potential to develop Utah into a technology center for geothermal and solar energy.

Photovoltaic Solar Energy

One of the most important policies under consideration by the State of Utah is the requirement that Utah power companies provide a certain percentage of their power from renewable sources (RPS, renewable portfolio standards). This is a necessary step which deserves full support. But additional policies are needed to address Utah's special situation.

Experience from other states shows that RPS typically promotes the one presently cheapest clean energy, which is wind-generated electricity. Electricity generated by solar panels mounted on individual homes is still too expensive (although the costs are slowly falling), and it is difficult for homeowners to get favorable credit terms. Specific policies are needed to encourage the installation of solar panels. Germany's Feed-In Tariffs (FIT) are a possibility which proved successful: the utility companies have to write long term contracts (up to 20 years) in which they obligate themselves to photovoltaic electricity from the households at prices covering the producer's costs plus a little bit of profit. This cost structure is such that the distributed energy suppliers get a higher price from solar panels installed this year than if they wait and install slightly more efficient solar panels next year. This generates a predictable revenue stream which can be easily financed, thus encouraging early adoption of the technology. This again accelerates the process in which this technology matures and becomes cost effective. Data are available which say that this makes photovoltaic energy cheaper in the long run than other policies.

Utah is less densely populated than Germany and has much more sun. Therefore an adaptation of FIT to Utah might want to tie the capacity installed in a household to the average consumption of that household, in order to locally match the distributed generation of electricity with its consumption. There is also a good temporal match since PVC cells produce most at the times of peak demand from air conditioners. An obstacle to be overcome in Utah would be the requirements that power companies buy only the cheapest power. In the long term, the policies proposed here are cheaper than seeking the lowest price at the moment.

Geothermal Energy

Utah has the capacity to produce 30 percent of its electricity by geothermal means. Geothermal energy is the only renewable energy which can provide the base load without having to store energy. It uses little water and produces little noise. In addition, it can quickly and easily adapt its output to demand. Given these advantages, geothermal energy should be targeted as one of the backbones of the electricity supply in Utah.

Since experience with geothermal as one of the main pillars of energy supply is rare, Utah can break new paths with carefully selected policies.

Geothermal facilities are small enough to be owned locally and clean enough to be situated near living areas. The technology is amenable to direct use of the heat; in some situations, geothermal energy must even be considered principally a source of heat, with electricity an additional bonus. Therefore policies are necessary to encourage direct use of the heat for space heating and greenhouses etc., in addition to the electricity use.

The main cost factor in geothermal energy is the location and drilling of the wells. Wells must be deep, which makes them expensive, and it is not certain whether they will be fruitful. Federal (DOE) or state programs for cost-shared drilling and the funding of the initial well for a small company might be considered. Geothermal drilling is a somewhat neglected sibling of oil drilling; there is high potential for efficiency improvements by targeted research. After the initial investment, operating costs are low; therefore low-cost loans would lower the threshold for private investment. The State government may also consider guaranteeing power purchase agreements between utilities and power companies in order to lower the interest costs.

Residential/Commercial/Industrial (Energy Demand)

No comments submitted.

Transportation/Land Use

Submitted by Bill Tibbitts,Anti-Hunger Action Committee on June 12, 2007:

Dear Blue Ribbon Council on Climate Change:

The time is approaching when you will be asked to vote on final recommendations for initiatives to reduce carbon emissions in Utah. As the director of an organization that includes a large number of bus riders, it is very exciting to see that one of the recommendations coming from the Transportation Stakeholder Working Group is to Develop Mass Transit. It is important to develop the basic public transportation infrastructure to enable as many people as possible to leave their cars at home and use public transportation to get to work, school and other appointments. It is also a very positive thing to see that fare reduction is mentioned explicitly in that recommendation. It is my belief that the current price structure is a major barrier to participation in public transportation for many Utah families. For families that are larger than one or two people it is cheaper to buy and maintain a car than purchase monthly bus passes. A large family can spend over $20 to ride the bus to and from a movie. This discourages use of public transportation.

It seems to me that the recommendation for fare reduction needs to be made more explicit. I would suggest that the Council propose that price for bus service be reduced from the current rate of $1.50 to $1 and that the price of a monthly pass be reduced from $50 to $30. The number of passengers on UTA buses has been declining for several years.

The UTA Board recently voted to raise the price for bus fare to $2 over the next 19 months. If that increase is necessary to meet UTA's budget goals then it seems like the state could help them to make up the difference. Fare box revenue is a small part of UTA's total budget and so the costs for doing this would be cheaper than some of the other proposals being put before the Council. I believe that a significantly decreased price on a monthly pass would actually increase UTA's revenue. Right now you need to use a bus pass 34 times in a month to break even. This means only the most devoted users of public transportation purchase the pass. If a pass cost something closer to the price of riding 10-15 times then customers who currently ride 1-6 times to month would suddenly be tempted to purchase a monthly pass in a way that they currently are not.

Be that as it may, it is likely that the price increases that the UTA Board recently approved are not being driven by budget needs but are instead being driven by the belief of some some UTA Board members that people who ride the bus and TRAX should pay as much as possible for the costs of that service. The problem with that belief is that it assumes UTA's share of the transportation market is fixed. Right now over 19 people in Salt Lake County drive to work in a car alone for every one person who uses public transportation to get to work. With rising gas prices and all the current interest around local air quality and climate change. Many of those people would be more open to using public transportation if they were approached in the right way and the costs for public transportation were not also increasing.

Given the above, I would like to further suggest that you consider splitting the goal to "Develop mass transit" into two parts. The first part would be related to infrastructure, and could still be called "Develop mass transit". The second goal would deal with eliminating barriers people have to using public transportation and conducting the kind of social marketing necessary to convince people to give public transportation a chance. I guess this goal could be called, "Eliminate barriers and increase use of existing mass transit." According to 2005 data from the Census Bureau, 17,500 people in Salt Lake County use public transportation to get to work. The state could play a very significant role in doubling that number by: a) promoting use of public transportation by state employees and firms that contract with the state, b) helping to decrease prices, as discussed above, and c) taking a leadership role in promoting the benefits of public transportation with the public.

Thank you for taking the time to serve on this important Council and thank you for taking the time to read through this overly wordy email. If you have any questions about any of the points that I have made please call me about them at 364-7765 ex 131.

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